

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants : Kenji OSHIMA et al.

Group Art Unit : 2853

Appl. No. : 10/533,562

Examiner : Ly T. TRAN

(U.S National Stage of PCT/JP04/014907)

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Confirmation No. 4028

For : INK JET RECORDING APPARATUS AND INK JET RECODING METHOD

RESPONSE UNDER 37 C.F.R. §1.111

Commissioner for Patents

U.S. Patent and Trademark Office

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Sir:

Responsive to the non-final Office Action mailed in the above-captioned application on August 9, 2007, in which the three month shortened statutory period for submitting a response runs to November 9, 2007, Applicants respectfully request reconsideration and allowance of the present application in view of the following:

Amendments to the Claims are reflected in the listing of claims which begin on page 2 of this paper.

Remarks begin on page 15 of this paper.

AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions and listings of claims in the application.

Listing of Claims:

1. (Currently Amended) An ink jet recording apparatus which includes an ink jet head whose recording-medium opposing surface that opposes a recording surface of a recording medium is furnished with an ink ejecting portion formed with open ends of a plurality of nozzle holes for ejecting a UV curable ink, and a head moving mechanism for putting the ink jet head into reciprocating motion in a predetermined direction parallel to the recording surface of the recording medium, and which performs recording by ejecting the ink from the nozzle holes of the ink jet head onto the recording surface of the recording medium and then curing the ink ejected and attached onto the recording surface of the recording medium by irradiation with ultraviolet light, at least when the head moving mechanism puts the ink jet head into a forward motion of the reciprocating motion,

wherein the ink jet head or a moving member which moves together with the ink jet head is provided with a plurality of ultraviolet light emitting diodes for emitting the ultraviolet

light to the ink attached onto the recording surface of the recording medium to cure the ink,

wherein the apparatus is configured so that the ultraviolet light emitted from the ultraviolet light emitting diodes is applied via a transparent light guiding member to the ink attached to the recording medium.

2. (Cancelled)

3. (Cancelled)

4. (Currently Amended) The ink jet recording apparatus of claim 3, wherein each ultraviolet light emitting diode in each ultraviolet-light-emitting-diode row is disposed in a position corresponding to the middle position between two adjacent ultraviolet light emitting diodes arranged in a neighboring one of the ultraviolet-light-emitting-diode rows, so that the ultraviolet light emitting diodes in the two adjoining ultraviolet-light-emitting-diode rows form a zigzag pattern.

5. (Currently Amended) ~~The ink jet recording apparatus of claim 2,~~ An ink jet recording apparatus which includes an ink jet head whose recording-medium opposing surface that opposes a recording surface of a recording medium is furnished with an ink ejecting portion formed with open ends of a plurality of nozzle holes for ejecting a UV curable ink, and a head moving

mechanism for putting the ink jet head into reciprocating motion in a predetermined direction parallel to the recording surface of the recording medium, and which performs recording by ejecting the ink from the nozzle holes of the ink jet head onto the recording surface of the recording medium and then curing the ink ejected and attached onto the recording surface of the recording medium by irradiation with ultraviolet light, at least when the head moving mechanism puts the ink jet head into a forward motion of the reciprocating motion,

wherein the ink jet head or a moving member which moves together with the ink jet head is provided with a plurality of ultraviolet light emitting diodes for emitting the ultraviolet light to the ink attached onto the recording surface of the recording medium to cure the ink, wherein the ultraviolet light emitting diodes, when seen from a direction perpendicular to the recording surface of the recording medium, are arranged to form one or a plurality of linear rows that extend in a direction perpendicular to the direction of the reciprocating motion of the ink jet head; and

wherein the open ends of the nozzle holes are arranged in the ink ejecting portion to form at least one or a plurality of linear rows that extend in a direction perpendicular to the direction of the reciprocating motion of the ink jet head, and the number of the ultraviolet light emitting diodes arranged in each ultraviolet-light-emitting-diode row is smaller than the number of the

nozzle hole open ends existing in each nozzle-hole-open-end row.

6. (Currently Amended) The ink jet recording apparatus of claim 2 5, wherein ~~the open ends of the nozzle holes are arranged in the ink ejecting portion to form at least one or a plurality of linear rows that extend in a direction perpendicular to the direction of the reciprocating motion of the ink jet head, and~~ the ultraviolet light emitting diodes existing on both ends of each ultraviolet-light-emitting-diode row are positioned outwardly of the nozzle hole open ends existing on both ends of each nozzle-hole-open-end row with respect to the direction of the nozzle-hole-open-end row.

7. (Currently Amended) ~~The ink jet recording apparatus of claim 2, An ink jet recording apparatus which includes an ink jet head whose recording-medium opposing surface that opposes~~ a recording surface of a recording medium is furnished with an ink ejecting portion formed with open ends of a plurality of nozzle holes for ejecting a UV curable ink, and a head moving mechanism for putting the ink jet head into reciprocating motion in a predetermined direction parallel to the recording surface of the recording medium, and which performs recording by ejecting the ink from the nozzle holes of the ink jet head onto the recording surface of the recording medium and then curing the ink ejected and attached onto the recording surface of the

recording medium by irradiation with ultraviolet light, at least when the head moving mechanism
puts the ink jet head into a forward motion of the reciprocating motion,

wherein the ink jet head or a moving member which moves together with the ink jet head
is provided with a plurality of ultraviolet light emitting diodes for emitting the ultraviolet light to
the ink attached onto the recording surface of the recording medium to cure the ink,

wherein the ultraviolet light emitting diodes, when seen from a direction perpendicular to
the recording surface of the recording medium, are arranged to form one or a plurality of linear
rows that extend in a direction perpendicular to the direction of the reciprocating motion of the
ink jet head; and

wherein the length, in the direction of the ultraviolet-light-emitting-diode rows, of a
portion of the recording surface of the recording medium on which recording is performed in a
single forward motion of the ink jet head is smaller than the length, in the direction of the
ultraviolet-light-emitting-diode rows, of a portion of the recording surface of the recording
medium which can be irradiated with ultraviolet light emitted from all of the ultraviolet light
emitting diodes during the single forward motion.

8. (Currently Amended) The ink jet recording apparatus of claim 2 7, wherein a pattern
mask is provided between the ultraviolet light emitting diodes and the recording medium so as to

reduce difference in illumination of ultraviolet light on the recording surface of the recording medium between a portion of the recording surface which corresponds to the middle position between any two adjacent ultraviolet light emitting diodes in each ultraviolet-light-emitting-diode row and portions of the recording surface which correspond to the positions of those two ultraviolet light emitting diodes.

9. (Cancelled)

10. (Previously Presented) The ink jet recording apparatus of claim 1, wherein the apparatus is configured so that each time the ink jet head performs a forward motion and a backward motion of the reciprocating motion, the ink is ejected from the nozzle holes of the ink jet head onto the recording surface of the recording medium so as to perform recording, and the ultraviolet light emitting diodes are disposed at both sides of the ink ejecting portion with respect to the direction of the reciprocating motion of the ink jet head.

11. (Previously Presented) The ink jet recording apparatus of claim 10, wherein the apparatus is configured so that in each of the forward and backward motions of the ink jet head, at least the ultraviolet light emitting diodes rearward of the ink ejecting portion with respect to the moving direction of the ink jet head emit the ultraviolet light.

12. (Previously Presented) The ink jet recording apparatus of claim 1, wherein the

apparatus is configured so that only when the ink jet head performs a forward motion of the reciprocating motion, the ink is ejected from the nozzle holes of the ink jet head onto the recording surface of the recording medium so as to perform recording, and

the ultraviolet light emitting diodes are disposed rearward of the ink ejecting portion with respect to the direction of the forward motion of the ink jet head.

13. (Previously Presented) The ink jet recording apparatus of claim 1, wherein the nozzle holes are formed in a nozzle plate which forms the recording medium opposing surface of the ink jet head, and

the ultraviolet light emitting diodes are disposed on the nozzle plate.

14. (Previously Presented) The ink jet recording apparatus of claim 1, wherein the nozzle holes are formed in a nozzle plate which forms the recording medium opposing surface of the ink jet head, and

the ultraviolet light emitting diodes are disposed on a member other than the nozzle plate.

15. (Previously Presented) The ink jet recording apparatus of claim 1, wherein the apparatus is configured so that the ultraviolet light emitting diodes are placed in a case and that the ultraviolet light is emitted through a surface of the case.

16. (Previously Presented) The ink jet recording apparatus of claim 15, wherein the case

is disposed so that the ultraviolet light emitting surface thereof is in the same plane as the recording medium opposing surface of the ink jet head.

17. (Previously Presented) The ink jet recording apparatus of claim 15, wherein the case is disposed so that the ultraviolet light emitting surface thereof is located closer to the recording medium than the recording medium opposing surface of the ink jet head is.

18. (Previously Presented) The ink jet recording apparatus of claim 15, wherein the case is disposed so that the ultraviolet light emitting surface thereof is located farther from the recording medium than the recording medium opposing surface of the ink jet head is.

19. (Previously Presented) The ink jet recording apparatus of claim 15, wherein the case is disposed at least rearward of the ink ejecting portion with respect to the direction of the forward motion of the ink jet head, and

the ultraviolet light emitting surface of the case is tilted with respect to the recording medium opposing surface of the ink jet head so that the side of the ultraviolet light emitting surface closer to the ink ejecting portion is located closer to the recording medium than the opposite side of the case is.

20. (Previously Presented) The ink jet recording apparatus of claim 15, wherein the case

is disposed at least rearward of the ink ejecting portion with respect to the direction of the forward motion of the ink jet head, and

a light blocking member for preventing part of the ultraviolet light emitted by the ultraviolet light emitting diodes from reaching the ink ejecting portion is provided between the case and the ink ejecting portion.

21. (Previously Presented) The ink jet recording apparatus of claim 1, wherein a heat conduction member for conducting, to the ink within the ink jet head, heat produced by the emission by the ultraviolet light emitting diodes is provided.

22. (Previously Presented) The ink jet recording apparatus of claim 1, wherein a radiator for dissipating heat produced by the emission by the ultraviolet light emitting diodes is provided.

23 - 51. (Cancelled)

52. (New) An ink jet recording apparatus to perform recording by ejecting an UV curable ink onto a recording surface of a recording medium comprising:

an ink jet head having a recording medium opposing surface that opposes the recording surface of the recording medium, the recording medium opposing surface including a plurality of nozzle holes to eject a UV curable ink on the recording surface of the recording medium;

a carriage configured to put the ink jet head into reciprocating motion in a first direction parallel to the recording surface of the recording medium, the nozzle holes being arranged to form one or a plurality of linear ink holes rows that extend in a second direction perpendicular to the first direction; and

a plurality of ultraviolet light emitting diodes configured to emit ultraviolet light to the UV curable ink ejected onto the recording surface of the recording medium to cure the UV curable ink, the ultraviolet light emitting diodes being arranged to form one or a plurality of linear ultraviolet light emitting diode rows that extend in the second direction, wherein the number of the ultraviolet light emitting diodes in each of the linear ultraviolet light emitting diode rows is smaller than the number of nozzle holes in each of the nozzle holes rows.

53. (New) The ink jet apparatus according to claim 52, wherein each ultraviolet emitting diode in each of the linear ultraviolet light emitting diode rows is disposed in a position corresponding to a middle position between two adjacent ultraviolet light emitting diodes arranged in a neighboring one of the plurality of the linear ultraviolet light emitting diode rows,

so that the ultraviolet light emitting diodes in the two adjoining linear ultraviolet light emitting diode rows form a zigzag pattern.

54. (New) The ink jet recording apparatus according to claim 52, wherein the ultraviolet light emitting diodes existing on both ends of each of the linear ultraviolet light emitting diode rows are positioned outwardly of the nozzle holes existing on both ends of each of the linear nozzle holes rows with respect to the second direction.

55. (New) An ink jet recording apparatus to perform recording by ejecting an UV curable ink onto a recording surface of a recording medium comprising:

an ink jet head having a recording medium opposing surface that opposes the recording surface of the recording medium, the recording medium opposing surface including a plurality of nozzle holes to eject a UV curable ink on the recording surface of the recording medium;

a carriage configured to put the ink jet head into reciprocating motion in a first direction parallel to the recording surface of the recording medium, the nozzle holes being arranged to form one or a plurality of linear ink holes rows that extend in a second direction perpendicular to the first direction; and

a plurality of ultraviolet light emitting diodes configured to emit ultraviolet light to the UV curable ink ejected onto the recording surface of the recording medium to cure the UV curable ink, the ultraviolet light emitting diodes being arranged to form one or a plurality of linear ultraviolet light emitting diode rows that extend in the second direction, wherein a length, in the second direction, of a first area onto which the nozzle holes eject the UV curable ink during a single forward motion of the ink jet head by the carriage is smaller than a length in the second direction, of a second area onto which the ultraviolet light emitting diodes emit the ultraviolet light during the single forward motion.

56. (New) An ink jet recording apparatus to perform recording by ejecting an UV curable ink onto a recording surface of a recording medium comprising:

an ink jet head having a recording medium opposing surface that opposes the recording surface of the recording medium, the recording medium opposing surface including a plurality of nozzle holes to eject UV curable ink on the recording surface of the recording medium;

a carriage configured to put the ink jet head into reciprocating motion in a first direction parallel to the recording surface of the recording medium, the nozzle holes being arranged to

form one or a plurality of linear ink holes rows that extend in a second direction perpendicular to the first direction;

a plurality of ultraviolet light emitting diodes configured to emit a ultraviolet light to the UV curable ink ejected onto the recording surface of the recording medium to cure the UV curable ink; and

a case configured to accommodate the plurality of ultraviolet light emitting diodes ~~and~~ having a transparent light transmitting surface to emit the ultraviolet light onto the recording surface of the recording medium.

REMARKS

Re-examination and allowance of the present application is respectfully requested.

Initially, Applicants thank the Examiner for considering the materials cited in the Information Disclosure Statement that was filed on August 3, 2005. However, the Examiner has inadvertently failed to acknowledge Applicants' claim for foreign priority and that the certified copy of the priority document has been received. The Examiner is respectfully requested to indicate such in the next official communication.

In addition, the Examiner has not indicated the acceptability of the filed drawings. Absent an indication by the Examiner in the next official communication, Applicants believe the filed drawings to be acceptable.

The Examiner indicated that claims 4-8 and 19 are objected to as being dependent upon a rejected base claim, but that these claims would be allowable if they are amended to be placed in independent form. Applicant wishes to clarify the record with respect to the basis for the patentability of these claims. While Applicants do not disagree with the Examiner's indication that certain identified features are not disclosed by the references, as noted by the Examiner, Applicants wish to clarify that the claims in the present application recite a combination of features, and the basis for patentability of these claims is based on the totality of the features recited therein.

As will be discussed below, Applicants amend claims 5 and 7 to place them in independent form, including substantially all the limitations of base claim 1, and amend the dependency of claims 6 and 8. Claim 19 is not amended, as it now depends from amended claim 1, to be discussed below.

Claims 23-51 are canceled in view of the finality of the restriction requirement. However, Applicants expressly reserve the right to submit similar type claims in another application.

Claims 1-3 (inadvertently noted as claims 1-4), 9-18 and 20-22 stand rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent 6,783,227 to SUZUKI et al. In this regard, while paragraph 3 of the Detailed Action portion of the Office Action states that claim 4 is rejected, Applicants submit that this indication is in error, and that claim 4 contains allowable subject matter, as indicated in paragraph 7 of the Office Action Summary sheet and page 7 of the Detailed Action portion of the Office Action.

Without acquiescing to the appropriateness of the rejection, Applicants herewith amend objected to claims 5 and 7 to advance the prosecution of the present application by placing them in independent form, including substantially all the limitations of base claim 1 and intervening claim 2. Applicants further cancel claims 2 and 3, and revise claims 4 and 6 to depend from

amended claim 5 and claim 8 to depend from amended claim 7. Thus, Applicants submit it is not necessary to discuss the rejection of claims 2 and 3.

Applicants respectfully traverse the rejection of claims 9-18 and 20-22. According to a feature of the present invention, an ink jet printer has nozzle holes to eject ink. The ink is UV curable by an ultraviolet light. The ink jet apparatus includes a UV LED as the light source to emit UV light towards the ink ejected onto a recording medium (e.g., paper). As shown in Fig. 3 and discussed at paragraph [0139] of U.S. Patent Application Publication 2006-0007290 of Applicants' drawings, the light source includes a case 8. The case 8 has a light emitting surface that is transparent on the side proximate the recording medium.

In rejecting claims 9-18 and 20-22, the Examiner asserts that case 9 of the '227 SUZUKI et al. patent corresponds to Applicants' case 8. Applicants respectfully traverse this assertion. Applicants submit that case 9 of the '227 SUZUKI et al. patent fails to disclose or suggest that the case has a transparent surface to emit light, as is taught by Applicant's invention.

By the current amendment, Applicants amend claim 1 to include the subject matter of claim 9, and additionally to clarify that the ultraviolet light emitting diodes is applied via a transparent light guiding member to the ink attached to the recording medium. Applicants submit that at least this feature is lacking from the '227 SUZUKI et al. patent.

In order to set forth a rejection under 35 U.S.C. §102, each and every feature recited in a claim must be disclosed in a single reference. Since at least the transparent guiding member is not disclosed by the '227 SUZUKI et al. patent, Applicants submit that claims 9-18 and 20-22 are not anticipated by the '227 SUZUKI et al. patent. Accordingly, Applicants respectfully request the withdrawal of the 35 U.S.C. §102(e) rejection and an indication of the allowability of claims 9-18 and 20-22.

Applicants also respectfully traverse the 35 U.S.C. §103(a) rejection of claims 13, 17 and 18 as being obvious over U.S. Patent 6,786,589 to SUZUKI et al. As with the above-discussed rejection, Applicants submit that the '589 patent to SUZUKI et al. merely disclose a opening in case 9, and fails to disclose or suggest a transparent surface, as taught by Applicants' invention. Thus, Applicants submit that even if one attempted to modify the '589 SUZUKI et al. patent in the manner suggested by the Examiner, one would fail to arrive at the presently claimed invention, as such a modification would fail to at least include light from an ultraviolet light emitting diode being applied via a transparent light guiding member to the ink attached to the recording medium. Accordingly, Applicants submit that claims 13, 17 and 18 are not obvious over the '589 SUZUKI et al. patent. Thus, the Examiner is respectfully requested to withdraw this ground of rejection and to indicate the allowability of claims 13, 17 and 18.

Applicants also submit new claims 52-56 for the Examiner's consideration. Applicants submit that these claims are allowable for at least the reasons discussed above. Accordingly, the Examiner is respectfully requested to indicate the allowability of newly added claims 52-56.

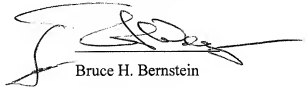
SUMMARY

In view of the fact that none of the art of record, whether considered alone or in combination, discloses or suggests the present invention as now defined by the pending claims, and in further view of the above amendments and remarks, reconsideration of the Examiner's action and allowance of the present application are respectfully requested and are believed to be appropriate.

Should the Commissioner determine that an extension of time is required in order to render this response timely and/or complete, a formal request for an extension of time, under 37 C.F.R. §1.136(a), is herewith made in an amount equal to the time period required to render this response timely and/or complete. The Commissioner is authorized to charge any required extension of time fee under 37 C.F.R. §1.17 to Deposit Account No. 19-0089.

If there should be any questions concerning this application, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,
Kenji OSHIMA et al.



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